Letters to the Editor

Stratification and disconformities in yellow sands of the Bassendean and Spearwood Dunes, Swan Coastal Plain, South-western Australia: discussion.

A recent article in the Journal of the Royal Society of Western Australia (Glassford & Semeniuk 1990) provided evidence for arid phase transport of Bassendean and Spearwood Dunes of the Swan Coastal Plain. While agreeing with many of the conclusions, I note on page 77 a report of no previous work on stratification of the deposits, on page 78 that the age is mainly mid-Pleistocene, and on page 88 that wind directions were mainly from the east. Various 'overprint' features are listed on page 90 without any mention of human activities, yet the latter are well known on the Plain, sometimes from deposits one or two metres deep with Holocene carbon dates (for example, Pearce 1981).

Some of these locations indicate deflation, but others certainly show accumulation of aeolian sediments, and the question remains, were they localised and related to disturbance of occupation, or were they part of a wider mobility of upper layers of soil during the Holocene?

Further, although Walyunga is not on the coastal plain it does contain a large dune 5.1 m deep formed by easterly winds, where the upper 1.9 m contains stratified sandy soil with occupation debris spanning most of the Holocene (Pearce 1978). It even shows good evidence of a mid-Holocene hiatus possibility linked to aridity.

Finally the Upper Swan site has alluvial deposits but it is close to Bassendean dunes and its dated soil profiles provide some clues to late Pleistocene changes (Pearce 1983).

Such studies and others published (Hallam 1987) and unpublished show that there was intermittent human usage of parts of the Swan Coastal Plain, and such studies should contribute towards interpretation and understanding of its development.

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References

Hallam S J 1987 Coastal does not mean littoral. Australian Archaeology 25:10-29.

Glassford D K & Semeniuk V 1990 Stratification and disconformities in yellow sands of the Bassendean and Spearwood Dunes, Swan Coastal Plain, South-western Australia. Journal of the Royal Society of Western Australia 72:75-93.

Pearce R H 1978 Changes in artifact assemblages during the last 8,000 years at Walyunga, Western Australia. Journal of the Royal Society of Western Australia 61:1-10.

Pearce R H 1981 Artifact usage and sea level changes. The Artifact 6:30-33.

Pearce R H 1983 Archaeology by system and chance. In: Archaeology at ANZAAS 1983 (ed M Smith) Western Australian Museum, Perth, 350-358.

Stratification and disconformities in yellow sands of the Bassendean and Spearwood Dunes, Swan Coastal Plain, South-western Australia: reply.

We welcome the opportunity provided by Pearce's letter to discuss aspects of our recent paper (Glassford & Semeniuk 1990).

In relation to our statement that generally there has been no previous work on stratification in yellow sands, we emphasise that our comments concern primary sedimentary statification in the yellow sands, and not the gross layering which locally is evident. The gross layering is due to either secondary alteration (pedogenic/diagenetic), or the superimposition of successive units which exhibit these secondary alteration features.

Human activities are suggested by Pearce as an agent for alteration of yellow sand. While we accept in principle that anthropogenic activities can alter and perturbate yellow sand in the younger parts of the sequence, we did not unequivocally detect the products of any such activity at our study sites. Our study concentrated on the description of primary stratification features in deep sequences of the yellow sands, as a basis for interpreting the primary sedimentary origin of such sequences. We described the types of alteration in these sands only as a basis for interpreting overprint features, to enable us to peer through the alteration effects. In our study the alteration features were overwhelmingly biological such as humification, or bioturbation by vegetation and fauna (e.g., termitarium structures), and chemical, such as bleaching and cementation. In regards to anthropogenic alteration effects, we also envisage that it would be more probable to detect such effects in areas where human occupation may have been more likely, that is, near river courses such as at Walyunga, or near estuaries such as at Mosman, where to date they have been mostly found. Our study sites, however, were well away from such localities. It is apparent that the bulk of the yellow sand pre-dates 10,000 years, and even *c*. 50,000 years, the approximate time that humans are believed to have arrived in Australia, so we do not expect that there should be evidence of human alteration in the deeper sequences of the yellow sand. These deeper sequences form the major bulk of the yellow sands.

Now for the matter of the·the age of the yellow sand sequences. We have no problem in accepting Holocene ages that have been obtained from radiocarbon dating of charcoal from the upper parts of the yellow sand sequences. However, such dates must be viewed as chronicling events only in the upper, near-surface parts of the yellow sand sequences. This surficial zone is also the only place in the yellow sand sequences where the radiocarbon material is located. These radiocarbon dates therefore should not be construed or extended to infer ages for the entire sequence of the yellow sand thoughout all parts of the Swan Coastal Plain. For instance, it it is possible that the sand overlying the uppermost disconformity at Site 7 (Fig. 3) was emplaced in the Holocene. But such a date should not be extrapolated throughout the whole sequence as the age of all the underlying sands and disconformities. Evidence of other authors also shows that yellow sand *underlies* Tamala Limestone. Thus, these yellow sands predate the limestone, and hence must be at least Pleistocene. A Holocene age for the upper, surficial part of a thick yellow sand sequence, or a Holocene age for an isolated outlier of yellow sand, should not be used to derive an age for the entire yellow sand sequence elsewhere. We envisage that the upper, surficial part of the yellow sands had phases of activity and mobility during the early to mid Holocene, and during these times, human occupation sites in this region could be expected to be buried. At present we are preparing a paper (Semeniuk & Glassford, in prep.) on the remobilisation of yellow sands in coastal areas. This will explain some of the ages and sequences evident in yellow sands near the coast.

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Reference

Glassford D K & Semeniuk V 1990 Stratification and disconformities in yellow sands of the Bassendean and Spearwood Dunes, Swan Coastal Plain, South-western Australia. Journal of the Royal Society of Western Australia 72:75-93.

Recent Advances in Science in Western Australia

Earth Sciences

Much of the Fortescue Group in the Hamersley Basin is older (2765-2687 Ma) than the Yilgarn granite-greenstone terrane according to N T Arndt of the Max-Planck-Institut für Chemie, Germany, and Australian colleagues. The platform cover was being deposited on the Pilbara granite-greenstone terrane while the Yilgarn granite-greenstone terrane was still being developed:

> Arndt N T, Nelson D R, Compston W, Trendall A F, & Thorne A M 1991 The age of the Fortescue Group, Hamersley Basin, Western Australia, from ion microprobe zircon U-Pb results. Australian Journal of Earth Sciences 38:261-281.

A useful synthesis and interpretation of seafloor spreading around Australia from 160 Ma to present, based on changes in plate geometry, is provided by J J Veevers and colleagues of the Macquarie University School of Earth Sciences:

> Veevers J J, Powell C McA & Roots S R 1991 Review of seafloor spreading around Australia. I. Synthesis of the patterns of spreading. Australian Journal of Earth Sciences 38:373-389.

Precambrian geological history of the Hamersley basin is interpreted in terms of plate tectonics by I M Tyler of the Geological Survey of WA. After development of the Fortescue and Hamersley Groups (2750-2300 Ma), a convergent phase began as a result of a collision between the Pilbara and Yilgarn Cratons resulting in the Capricorn Orogeny (2200-1600 Ma):

> Tyler I M 1991 The geology of the Sylvania Inlier and the southeast Hamersley Basin. Western Australia Geological Survey, Bulletin 138.

Detailed biostratigraphy has been used by J Backhouse of the Geological Survey of WA to correlate the coal seams in the Collie Basin and to compare them with the Karoo Basin in South Africa, demonstrating the value of pollen analysis in predicting the age of coal seams:

> Backhouse J 1991 Permian palynostratigraphy of the Collie Basin, Western Australia. Review of Palaeobotany and Palynology 67:237-314.

Two stages are recognised in the evolution of the southern transform margin of the Exmouth Plateau - rifting and shearing, followed by drifting with igneous intrusion and underplating - according to J M Lorenzo of the Lamont-Doherty Geological Observatory, New York, and colleagues at the Bureau of Mineral Resources, Canberra:

> Lorenzo J M, Mutter J C, Larson R L *et al.* 1991 Development of the continent-ocean transform boundary of the southern Exmouth Plateau. Geology 19:843-846.

Life Sciences

Banksia cuneata is the rarest of the 76 *Banksia* species, with only 350 plants surviving. The most limiting factor in regeneration after fire-induced seed release was survival over the first summer (less than 0.1% of seedlings in this study by Lamont and colleagues of the Curtin University of Technology), and survival was greatly improved by regular watering or transplanting to moister sites:

> Lamont B B, Connell S W & Bergl S M 1991 Seed bank and population dynamics of Banksia cuneata: the role of time, fire, and moisture. Botanical Gazette 153:114-122.

The term serotiny is suggested by B B Lamont at Curtin University of Technology as the most appropriate term for plants that retain some of their seeds for more than a year - this phenomenon is more widespread among shrubs and trees of south-western Australia than anywhere else in the world:

> Lamont B B 1991 Canopy seed storage and release - what's in a name? Oikos 60:266-268.

Lupin yields were improved by 10-90% when superphosphate was banded 5-8 cm below the seed compared with banding with the seed, and was decreased by 30-60% by topdressing P, according to R J Jarvis and M D A Bolland of the WA Department of Agriculture. Banding improved root interception and uptake of P:

> Jarvis R J & Bolland M D A 1991 Lupin grain yields and fertiliser effectiveness are increased by banding superphosphate below the seed. Australian Journal of Experimental Agriculture 31:357-366.

Note from the Hon Editor: Members and non-members of the Royal Society of Western Australia are encouraged to submit Letters to the Editor and contributions to Recent Advances in Science in Western Australia. For the latter, please provide short (2-3 sentence) summaries of recent significant papers by Western Australian scientists or others writing about Western Australia, together with a copy of the title, abstract and authors' names and addresses, to the Hon Editor or a member of the Publications Committee: Dr S D Hopper (Life Sciences), Dr A E Cockbain (Earth Sciences), and Assoc Prof J Webb (Physical Sciences). Final choice of articles is at the discretion of the Hon Editor.